

Apple and spirea aphids (Homoptera:Aphididae) on apples in south central Washington

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ABSTRACT

Aphids were collected from 75 different apple orchards in south central Washington during 1994 and 1995. In 1994, 88% of those examined were spirea aphid (*Aphis spiraecola* Patch). In 20 orchards we found only spirea aphids; in 11, most were spirea aphids and in 2, all were apple aphids (*A. pomi* deGeer). In 1995, 76% of those examined were spirea aphids. In 13 orchards we found only spirea aphids; in 22, most aphids were spirea; in one, all, and in 6 most, were apple aphids. In the two years combined, 33 orchards (44%) had only spirea aphids, 33 (44%) had predominantly spirea aphids, 6 (8%) had mainly apple aphids and 3 (4%) had only apple aphids. There were no clear differences in distribution of the two species over time or on different apple cultivars.

Key words: Aphid, *Spirea*, apple, orchard

INTRODUCTION

The apple aphid (*Aphis pomi* deGeer) was first reported from Washington in 1883 (Pfeiffer 1991). Since then it has probably become the dominant species on apples. The spirea aphid (*A. spiraecola* Patch) is indistinguishable from the apple aphid under field conditions. Spirea aphid was first recorded in British Columbia from Vancouver on *Calycanthus fertilis* in 1976 and later from Osoyoos on *Morus alba* in the Okanagan Valley in 1981 (Forbes and Chan 1989). Beers *et al.* (1993) lumped the two together as "green aphids" on apple in the Pacific Northwest. We are not sure how long the spirea aphid has been in Washington, but Halbert and Voegtlin (1992) found spirea aphids in pan traps in Washington wheat fields in 1984.

Spirea and apple aphids have distinct life histories. Apple aphids feed mainly on apple foliage and occasionally on that of pear and hawthorn. Spirea aphids alternate between the primary host, spirea, and a wide variety of other, secondary hosts. Apple aphids overwinter as eggs on apple whereas spirea aphids overwinter as eggs on spirea, citrus or other plants and only infest apple trees during the summer. Therefore, dormant and delayed dormant sprays applied to apple trees would not affect spirea aphid. Hogmire *et al.* (1990, 1992) showed differences in insecticide susceptibility between these two species.

Pfeiffer *et al.* in 1989 found the spirea aphid to predominate over the apple aphid in Virginia, West Virginia and Maryland. They interpreted their findings as the possible result of a recent shift in aphid species composition on apple.

Our study was conducted to determine the distribution of the spirea aphid infestation in apple orchards in south central Washington to improve the integrated management of the aphid.

MATERIALS AND METHODS

Aphids were collected from 75 different randomly selected "green aphid" infested apple orchards in south central Washington during 1994 and 1995. No orchards were sampled twice. At each orchard we collected alate aphids from at least 15 different randomly selected shoots from at least 5 trees to obtain 30 aphids. However, if it was difficult to find alate aphids in an orchard with a low infestation, aphids were collected from more than 15 shoots to obtain 30 aphids. Aphids from individual orchards were stored in alcohol until their distal rostral segments were measured under a microscope with 40X magnification using a ocular micrometer reticle with 0.025 mm gradations. Thirty aphids from each sample were examined and identified as apple or spirea aphids. Halbert and Voegtlin (1992) reported the length of the ultimate rostral segment was most useful for separating the two species. We used their method. The length of the ultimate rostral segment is greater than 0.12 mm in the apple aphid and less than 0.12 mm in the spirea aphid.

Table 1.

Occurrence of the apple and spirea aphids in south central Washington in 1994-1995. BR = Braeburn; FU = Fuji; GA = Gala; GD = Golden Delicious; RD = Red Delicious; RO = Rome.

Date	Location	Variety	% Spirea	% Apple	Date	Location	Variety	% Spirea	% Apple
5/9/94	Zillah	GA	0	100	5/23/95	Prosser	RD	93	7
5/10/94	Prosser	RO	0	100	6/5/95	Prosser	GD	0	100
8/24/94	Moxee	GD	91	9	6/5/95	Prosser	RD	7	93
8/25/94	Basin City	RD	64	36	6/5/95	Prosser	RD	4	96
8/25/94	Moxee	RD	5	95	6/5/95	Sunnyside	BR	93	7
8/26/94	Moxee	GA	75	25	6/6/95	Moxee	BR	52	48
8/26/94	Parker Hts	RD	100	0	6/6/95	Prosser	FU	38	62
8/26/94	Parker Hts	RD	100	0	6/6/95	Wapato	GD	94	6
8/26/94	Parker Hts	RD	94	6	6/6/95	Zillah	RD	92	8
8/26/94	Parker Hts	RD	100	0	6/7/95	Prosser	RD	79	21
8/29/94	Prosser	BR	95	5	6/7/95	Yakima	RD	76	24
8/29/94	Prosser	FU	100	0	6/7/95	Yakima	RD	86	14
8/29/94	Prosser	FU	100	0	6/7/95	Yakima	RD	96	4
8/29/94	Prosser	GA	100	0	6/7/95	Yakima	RD	13	87
8/29/94	Prosser	GA	100	0	6/7/95	Yakima	RD	90	10
8/29/94	Prosser	GA	100	0	6/7/95	Yakima	RD	60	40
8/29/94	Prosser	RD	90	10	6/30/95	Selah	RD	95	5
8/29/94	Prosser	RD	97	3	7/10/95	Parker	RD	100	0
8/29/94	Prosser	RD	100	0	7/10/95	Pasco	RD	97	3
8/29/94	Prosser	RO	100	0	7/20/95	Prosser	RD	52	48
8/29/94	Prosser	RO	100	0	8/15/95	Prosser	FU	77	23
8/31/94	Moxee	FU	100	0	8/15/95	Prosser	FU	90	10
8/31/94	Moxee	GD	100	0	8/15/95	Prosser	FU	83	17
8/31/94	Moxee	RD	100	0	8/15/95	Prosser	GA	100	0
8/31/94	Moxee	RD	100	0	8/15/95	Prosser	RD	100	0
9/2/94	Moxee	BR	97	3	8/15/95	Prosser	RD	80	20
9/2/94	Moxee	FU	100	0	8/15/95	Prosser	RD	93	7
9/2/94	Moxee	RD	100	0	8/15/95	Prosser	RD	13	87
9/2/94	Moxee	RD	100	0	8/15/95	Prosser	RD	100	0
9/2/94	Moxee	RD	100	0	8/15/95	Prosser	RO	56	44
9/7/95	Donald	FU	100	0	8/18/95	Moxee	GD	93	7
9/7/94	Moxee	BR	100	0	8/21/95	Prosser	GA	100	0
9/7/94	Moxee	GD	92	8	8/22/95	Moxee	GD	100	0
9/7/94	Moxee	RD	6	94	8/22/95	Moxee	RD	23	77
5/15/95	Prosser	RD	100	0	8/22/95	Moxee	RD	93	7
5/16/95	Prosser	RD	100	0	8/29/95	Moxee	BR	100	0
5/21/95	Prosser	RD	100	0	8/31/95	Prosser	GD	100	0
					9/10/95	Parker	RD	100	0

RESULTS AND DISCUSSION

We found spirea aphid in all but 3 samples and apple aphid in 42 of the 75 samples (Table 1). Neither species was clearly prevalent on a particular apple variety (Table 1). We suspected that there might be more apple than spirea aphids during May and June as compared to August and September but the data do not show any such trend.

In 1994, 88% of the 930 individuals examined were spirea aphids. In 20 orchards we found spirea aphid only, but in 11, most of the aphids were spirea and in 2, all were apple aphids. In 1995, 76% of the 1,260 aphids examined were spirea aphids. In 13 orchards we found only spirea aphids, in 22 others most aphids were spirea, in one all were apple aphids and in 6 most were apple aphids. In the two years combined, 33 orchards (44%) had spirea aphids only, 33 (44%) had predominately spirea aphid, 6 (8%) had mainly apple aphid and 3 (4%) had apple aphids only.

In 1994 and 1995, most of the green aphids found infesting apple trees in south central Washington were spirea. Clearly, the area has experienced a shift in aphid species composition on apples as reported from other parts of the world (Zehavi and Rosen, 1987; Pfeiffer et al. 1989). The extent of spirea aphid infestations on apple needs to be determined for other apple growing areas in Washington and neighboring British Columbia. For proper biological and chemical integrated pest management we need further information on the biology of spirea aphid in Washington. Possible differences between the species in effective natural enemies have not been examined to date.

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Interaction between the bluestain fungal associates of mountain pine, and pine engraver beetles, (*Dendroctonus ponderosae* and *Ips pini*, Coleoptera: Scolytidae) and their effects on the beetles

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ABSTRACT

We investigated the potential antagonism between the fungal associates of the pine engraver and mountain pine beetles. We measured and compared their rates of growth in bolts of lodgepole pine and in living trees: *Ophiostoma ips* from *Ips pini* against *O. clavigerum* from *Dendroctonus ponderosae*. We measured the length of lesions shown by discolored xylem, but we found both fungi outside of visibly stained areas, which showed that mere staining is not a reliable indicator of fungal growth. There were no significant differences in brood development or survival between the two beetle spp., when bolts were inoculated with either fungal associate.

Key words: Coleoptera:Scolytidae, bluestain fungi, *Pinus contorta*, Princeton, Williams Lake, B.C.

INTRODUCTION

The mountain pine beetle, *Dendroctonus ponderosae* Hopk., is one of the most destructive insect pests of mature pines in British Columbia (B.C.) (Unger 1993). In 1993, an average year for bark beetle activity, losses to the mountain pine beetle amounted to 4.8 million trees on nearly 45,000 hectares (Wood and Van Sickle 1992). Forest management for timber and other resources is often greatly disrupted by mountain pine beetle outbreaks. Current short-term management techniques to reduce timber losses from mountain pine beetle attack include sanitation logging, single-tree treatments, and the use of trap trees baited with pheromones (Unger 1993, Safranyik 1995).

A novel biological control technique is to bait trees attacked by mountain pine beetles with the aggregation pheromone of the pine engraver beetle, *Ips pini* Say. This approach is based on observations that secondary attacks by pine engraver beetles at very high densities often results in high mortality of mountain pine beetle broods (Andrews 1987, Humphreys and Ferris 1987, Rankin and Borden 1991). The reasons for this mortality are unknown, but Rankin and Borden (1991) speculated that the fungal associate of the pine engraver may have a direct antagonistic effect on brood development of the mountain pine beetle or on its fungal associate.

Ophiostoma ips is the bluestain fungus most closely associated with the pine engraver (Mathre 1964, Raffa and Smalley 1988, Furniss *et al.* 1995). Both *O. clavigerum* and *O. ips* are associated with the mountain pine beetle (Robinson 1962, Reid *et al.* 1967, Whitney 1971) although *O. clavigerum* is frequently the only bluestain fungus recovered (H.S. Whitney personal communication). Antagonism between the two fungi has been demonstrated by the reduced pathogenicity of *O. clavigerum* to seedlings of ponderosa